Dec 1st, 12:00 AM

# The increase in SCN reproduction on resistant soybean varieties—what does it mean?

Gregory L. Tylka
*Iowa State University*, gltylka@iastate.edu

# The increase in SCN reproduction on resistant soybean varieties – what does it mean?

Gregory L. Tylka, professor and extension nematologist, Plant Pathology, Iowa State University

The soybean cyst nematode (SCN), *Heterodera glycines*, is a consistent threat to profitable soybean production in the Midwest each year. In years of adequate to excess rainfall, like 2010 in Iowa, the short-term effect of SCN on soybean yields may be reduction of only a few bushels per acre. But in hot, dry years, yield loss can approach 50 percent or more. And no matter the extent of yield loss, SCN population densities (numbers) can increase dramatically during a growing season if susceptible soybean varieties are grown. And high SCN population densities increase the chances of soybean yields being greatly reduced due to nematode damage in future years.

## SCN-resistant soybean varieties – a great management tool

There are hundreds of soybean varieties that are resistant to SCN available for Iowa growers. The resistant varieties yield well in SCN-infested fields and they also keep SCN numbers from increasing. It's important to know what soybean varieties are resistant to the nematode and what type or "source" of resistance the varieties possess. Iowa State University recommends rotating different sources of resistance and different SCN-resistant varieties to prevent the buildup of SCN populations with increased reproduction on resistant soybean varieties (Figure 1).

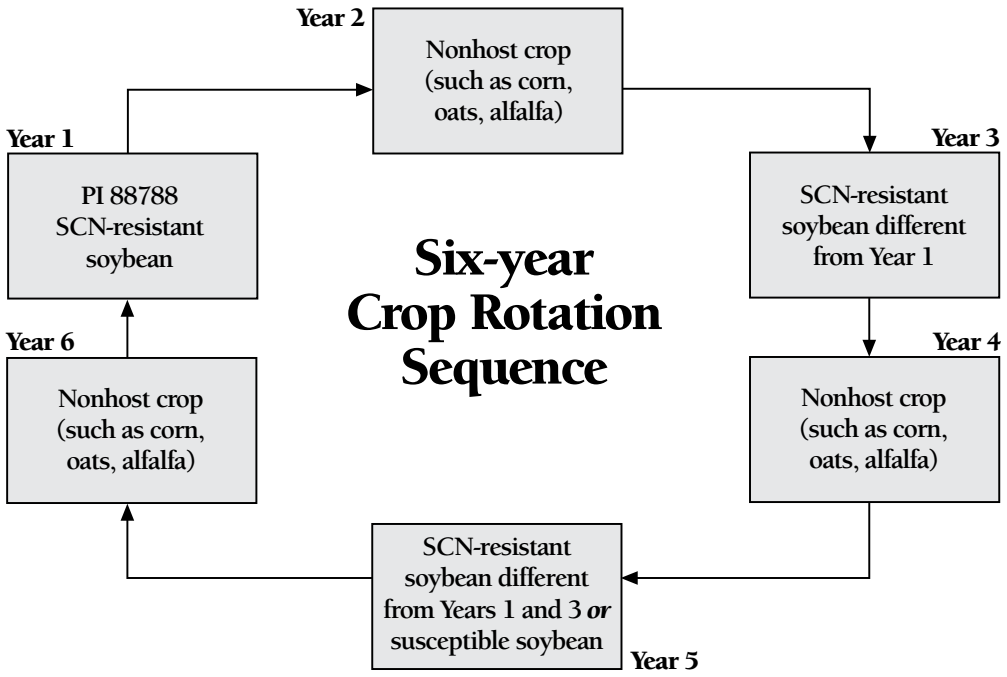


**Figure 1.** Crop rotation sequence recommended by Iowa State University for Iowa fields infested with low or moderate population densities of SCN to maintain profitable soybean yields and keep nematode population densities in check.

ISU Extension annually compiles and publishes a list of SCN-resistant soybean varieties in maturity groups 0, 1, 2, and 3. The 2010 version of the publication, titled "Soybean Cyst Nematode-resistant Soybean Varieties for Iowa" (ISU Extension publication PM 1649), was updated in October 2010 and is available at ISU Extension Online

Store at www.extension.iastate.edu/store. There are 813 SCN-resistant varieties listed in the 2010 publication, the most ever. But almost all of the SCN-resistant varieties in the publication have the same source of resistance, from a breeding line called PI 88788 (Figure 2). Only 15 of the 813 varieties in the publication have a source of resistance that is not PI 88788. Two of the Iowa State University varieties listed in the publication, "IAR2101 SCN" and "IAR3001 Phyto SCN", have sources of SCN resistance that have not been used in varieties in the list before.

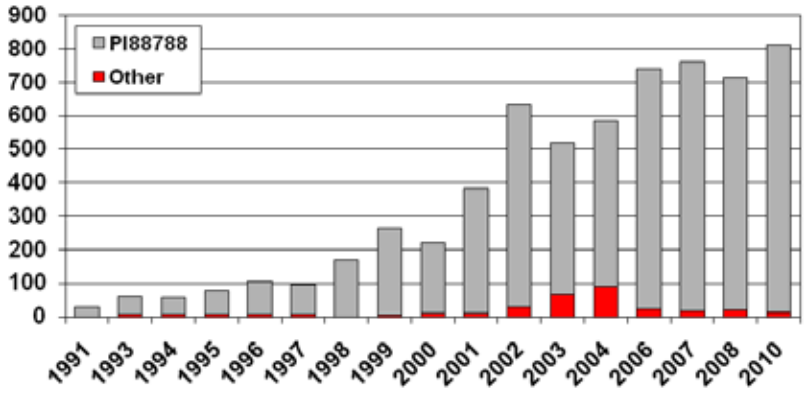


**Figure 2.** The number of SCN-resistant soybean varieties available for Iowa soybean growers from 1991 to 2010. Data were unavailable for 1992, 2005, and 2009. The dark portion of each bar represents the number of SCN-resistant soybean varieties with a specific source of resistance other than PI 88788.

## SCN populations adapting to resistant varieties

SCN-resistant soybean varieties are defined as allowing 10 percent or less SCN reproduction relative to a standard susceptible (non-resistant) soybean variety, Lee 74 (Schmitt and Shannon, 1992). So the 10 percent level of SCN reproduction is considered critical by many because it is the scientific definition of resistance to SCN in soybean.

In recent years, there have been reports from throughout the Midwest, including Iowa, Illinois, Indiana, Minnesota, and Missouri, that many SCN populations have elevated reproduction on PI 88788, the very common breeding line that is the source of SCN resistance in most SCN-resistant soybean varieties (Figure 2). For example, 65 percent of 260 SCN populations from Illinois surveyed in 2005 had 10 percent or greater reproduction on PI 88788 (Niblack et al., 2008). In Missouri, the SCN population in 78 percent of 45 samples collected in 2005 had 10 percent or greater reproduction on PI 88788 (Mitchum et al., 2007). And in Iowa, more than half of the 150 SCN populations collected and tested in 2007 and 2008 had greater than 10 percent reproduction on PI 88788 (Tylka, unpublished).

## Are SCN-resistant varieties with PI 88788 failing? Variety trial results provide an answer

The relationship between elevated (greater than 10 percent) reproduction of SCN on a resistant soybean variety and the performance of that variety in terms of yield and season-long nematode control is not widely known or discussed. And the consequences of elevated SCN reproduction on resistant soybean varieties with the PI 88788 source of SCN resistance may be surprising.

With soybean checkoff funding from the Iowa Soybean Association, the Iowa State University (ISU) SCN-resistant Soybean Variety Trial Program annually evaluates the yield and SCN control of hundreds of SCN-resistant soybean varieties in field experiments conducted at numerous locations throughout Iowa (see www.isuscntrials.info for results from 1997 to 2010). The resistant varieties are grown in replicated plots at each experimental location, soil samples are collected from each replicate plot at planting and at harvest to determine SCN population densities, and commonly grown SCN-susceptible varieties are included in each experiment. An HG type test is conducted on the SCN population at each experimental location to determine how well the SCN population in the field can reproduce on PI 88788, Peking, and the other sources of SCN resistance used in soybean varieties.

Almost all of the SCN-resistant varieties evaluated in the ISU SCN-resistant Soybean Variety Trial Program have PI 88788 as the source of SCN resistance. And many of the variety trial locations are now infested with SCN populations capable of 10 percent or greater reproduction on PI 88788. Yet most of the SCN-resistant varieties usually yield greater than the susceptible varieties at these locations.

For example, at a variety trial conducted near Cambridge, in central Iowa, in 2007, the field was infested with an SCN population that had 24.3 percent SCN reproduction on PI 88788 and only 0.1 percent reproduction on Peking (Tylka et al., 2008). This level of reproduction on PI 88788 would seem to indicate that an SCN-resistant variety with resistance from PI 88788 would not be as good of a choice for this field as a soybean variety with SCN resistance from another source, like Peking. But the soybean variety with Peking SCN resistance (Pioneer 93M53) yielded 56.8 bushels per acre and the three top-yielding SCN-resistant varieties (each with PI 88788 SCN resistance) averaged 65 bushels per acre, which was 10 bushels per acre more that the three top-yielding susceptible varieties (Tylka et al., 2008).

At the variety trial experiment near Vincent, in north central Iowa, that same year, there was an SCN population with 13.4 percent reproduction on PI 88788 and 0.1 percent reproduction on Peking, and three of the four top-yielding varieties at that location, yielding 51 to 55 bushels per acre, were varieties with SCN resistance derived from Peking.

Results similar to those from the experiment conducted near Vincent, Iowa, would be expected if there always was a direct and consistent relationship between SCN reproduction on a source of SCN resistance and yield of resistant varieties developed with that source of SCN resistance. But the results described above from Cambridge, Iowa, illustrate that the level of SCN reproduction on a source of SCN resistance does not necessarily indicate that yields of SCN-resistant varieties possessing that source of resistance will be reduced dramatically, at least for the PI 88788 source of SCN resistance.

## Summary

Results from numerous experiments conducted as part of the ISU SCN-resistant Soybean Variety Trial Program in the past several years indicate that soybean varieties with SCN resistance from PI 88788 are capable of producing high yields in SCN-infested fields, even if the nematode population in the field can reproduce on PI 88788 at a level exceeding 10 percent. The results also seem to illustrate that having SCN populations tested for the ability to reproduce on the different sources of SCN resistance, a test called the HG type test, may not provide information that is useful in predicting how well SCN-resistant soybean varieties will perform agronomically if grown in the SCN-infested fields.

## References

Mitchum, M.G., J.A. Wrather, R.D. Heinz, J.G. Shannon, and G. Danekas. 2007. Variability in distribution and virulence phenotypes of *Heterodera glycines* in Missouri during 2005. Plant Disease 91:1473-1476.

Niblack, T.L., A.L. Colgrove, K. Colgrove, and J.P. Bond. 2008. Shift in virulence of soybean cyst nematode is associated with use of resistance from PI 88788. Plant Health Progress doi:10.1094/PHP-2008-0118-01-RS.

Schmitt, D.P., and G. Shannon. 1992. Differentiating soybean responses to *Heterodera glycines* races. Crop Science 32:275-277.

Tylka, G.L. and M.P. Mullaney. 2010. Soybean cyst nematode-resistant soybean varieties for Iowa. Iowa State University Extension Publication Pm-1649. 27 pp.

Tylka, G.L., G.D. Gebhart, and C.C. Marett. 2008. Evaluation of soybean varieties resistant to soybean cyst nematode in Iowa – 2007. Iowa State University Extension Publication IPM 52. 27 pp.